



**National
Transportation
Safety Board**

What Happens on the Roads, Rails, and in the Skies: Sleep, Fatigue, and Transportation

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Board Member

Introduction to Sleep
Brown University
November 29, 2012



- 1) determining the probable cause of transportation accidents
- 2) making recommendations to prevent their recurrence



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All Modes



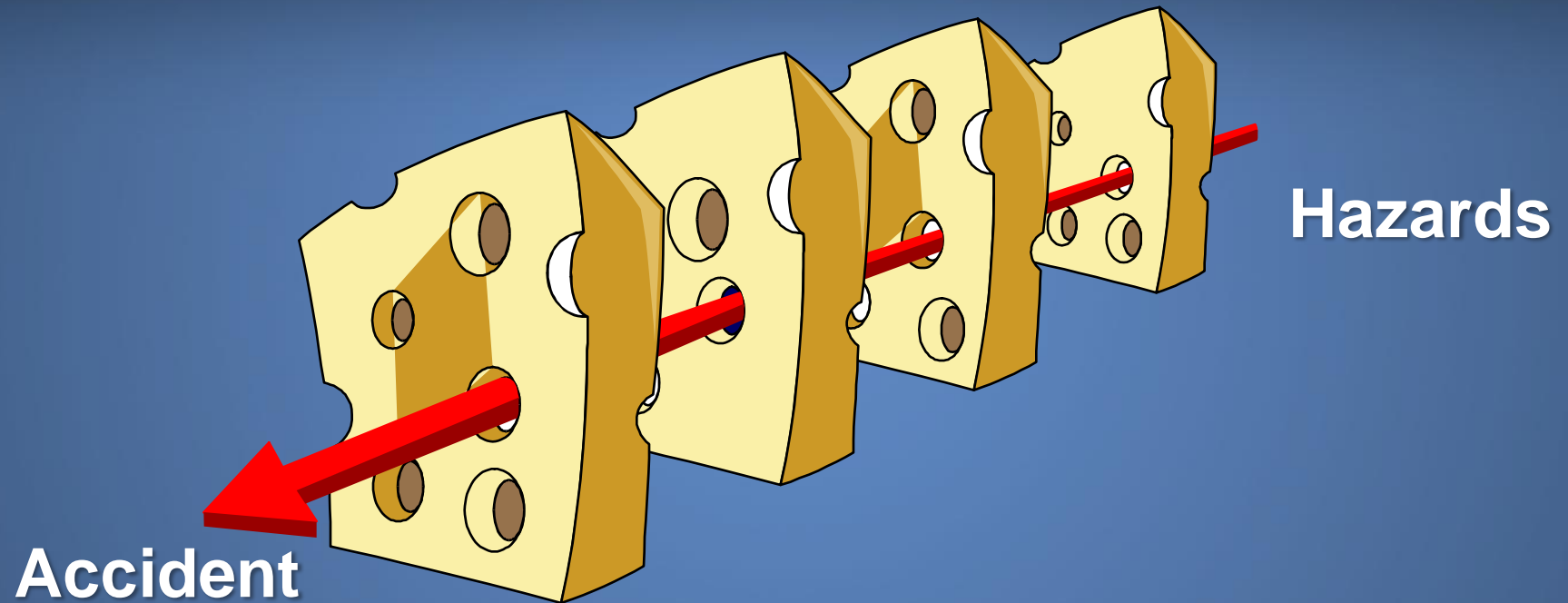
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Independent Federal Agency: Created in 1967

- ~ 132,000 accident investigations
- 13,500+ safety recommendations
- ~ 2,500 organizations/recipients
- 82% acceptance rate



“Swiss Cheese” Model (Reason)



Successive layers of defenses, barriers, and safeguards



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NTSB Investigative Process



On-scene Investigation

Organizational Meeting
Groups and Parties
Progress meetings
Media Briefings
Press Releases

A form titled "NTSB ID: DCA10000000" with fields for "Date", "City", "Local Time", "Time Zone", "Investigator", "Investigator's Title", "Investigator's Organization", "Investigator's Address", "Investigator's Phone", "Investigator's Email", "Investigator's Fax", "Investigator's Website", "Investigator's Signature", "Investigator's Date", "Investigator's Location", "Investigator's Country", "Investigator's State", "Investigator's City", "Investigator's Zip", "Investigator's Country Code", "Investigator's Phone Number", "Investigator's Email Address", "Investigator's Fax Number", "Investigator's Website Address", "Investigator's Signature", "Investigator's Date", "Investigator's Location", "Investigator's Country", "Investigator's State", "Investigator's City", "Investigator's Zip", "Investigator's Country Code", "Investigator's Phone Number", "Investigator's Email Address", "Investigator's Fax Number", "Investigator's Website Address".

Preliminary Report

Factual information



Public Hearing

Fact finding
Depositions
Witnesses
Docket



Board Meeting

Docket
Findings
Conclusions
Probable Cause
Safety Recommendations



Final Report

Government in the Sunshine Act



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NTSB Characterized as:

‘moral compass and industry conscience’

NTSB Chairman Deborah A.P. Hersman



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Guantanamo Bay Cuba

First NTSB aviation accident to
cite fatigue as probable cause

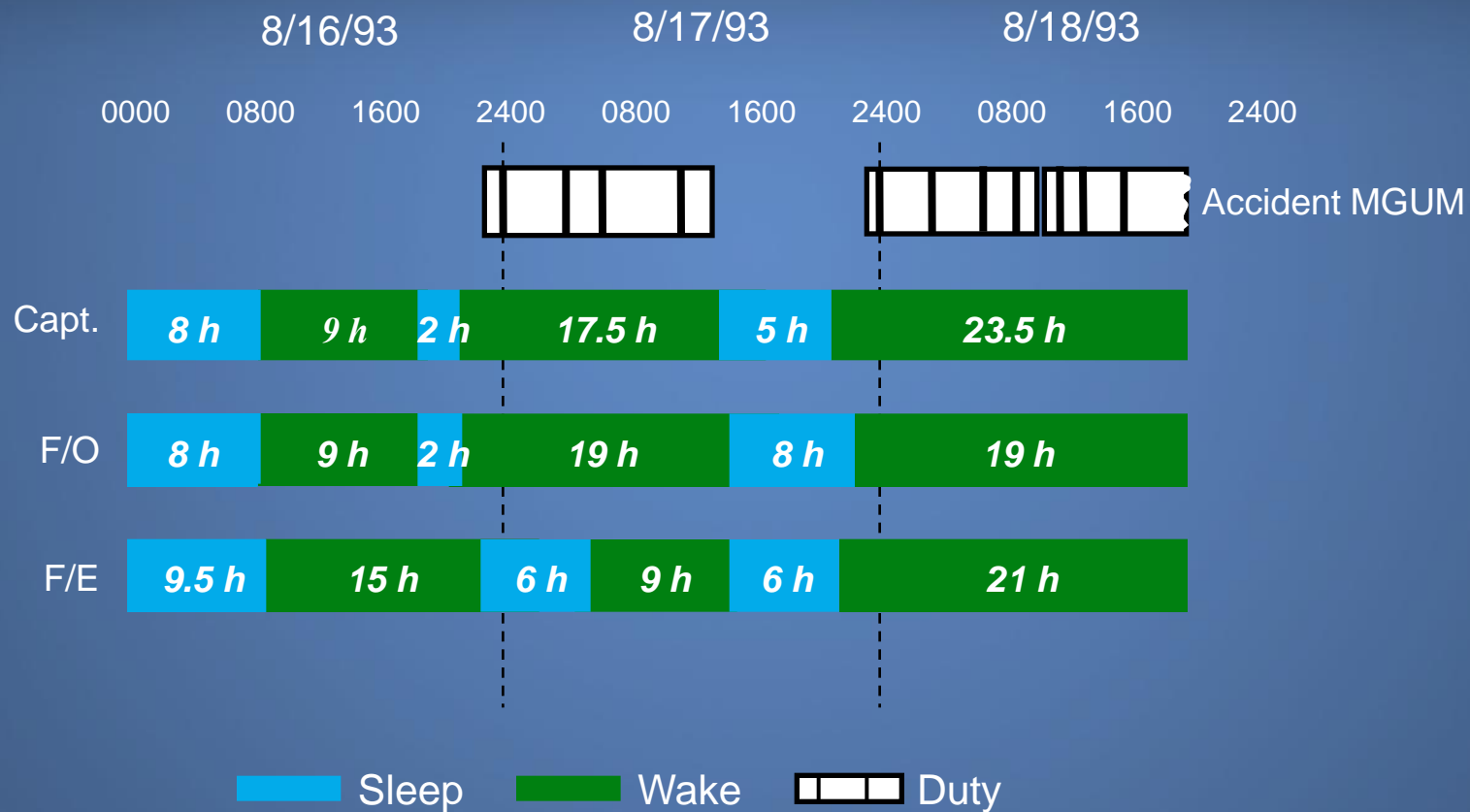


- acute sleep loss, sleep debt, circadian disruption



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Crew Sleep History



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Observed Performance Effects

- Degraded decision-making
- Visual/cognitive fixation
- Poor communication/coordination
- Slowed reaction time



Uncontrolled In-Flight Collision with Terrain
AIA Flight 808, Douglas DC-8-61, N814CK
U.S. NAS, Guantanamo Bay, Cuba, August 18, 1993

“The National Transportation Safety Board determines that the probable causes of this accident were the impaired judgment, decision making, and flying abilities of the captain and flight crew due to the effects of fatigue...”



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Miami, Oklahoma (June 26, 2009)

- Initial minor accident (~1:13 pm)
 - blocked eastbound I-44
- 2008 Volvo truck-tractor (~1:19 pm)
 - refrigerated semitrailer
 - traveling eastbound on I-44
 - 69 mph with cruise control engaged
 - without slowing or braking collided into queue of slowing & stopped vehicles



Fatigue Factors

- Off work for 3 weeks: day active/night sleep schedule
- 3am to 3pm shift work/drive schedule (since 1997)
- Early bedtime (2 hr phase advance in sleep time)
- Obtained min 3 hrs/max 5 hrs sleep prior to accident
- Subsequently diagnosed with mild sleep apnea



10 fatalities
3 serious injuries
2 minor injuries
5 no injuries

**Ford
Windstar**

**Kia
Spectra**

**Hyundai
Sonata**

Source: Oklahoma State Police



Probable Cause (fatigue)

“ . . . driver’s fatigue, caused by the combined effects of acute sleep loss, circadian disruption associated with his shift work schedule, and mild sleep apnea, which resulted in the driver’s failure to react to slowing and stopped traffic ahead by applying the brakes or performing any evasive maneuver to avoid colliding with the traffic queue. . . . ”





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Track Path Animation

Collision Between Two BNSF Railway Freight Trains

Red Oak, Iowa

April 17, 2011

DCA11FR002



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Probable Cause (fatigue)

“ . . . failure of the crew of the striking train to comply with the signal indication requiring them to operate in accordance with restricted speed requirements and stop short of the standing train because they had fallen asleep due to fatigue resulting from their irregular work schedules and their medical conditions.”





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MOST WANTED LIST

A program to increase the public's awareness of, and support for, action to adopt safety steps that can help prevent accidents and save lives. The following are ten of the current issues.



Addressing Human
Fatigue



General Aviation
Safety



Safety Management
Systems



Runway Safety



Bus Occupant Safety



Pilot & Air Traffic
Controller
Professionalism



Recorders



Teen Driver Safety



Addressing Alcohol-
Impaired Driving



Motorcycle Safety



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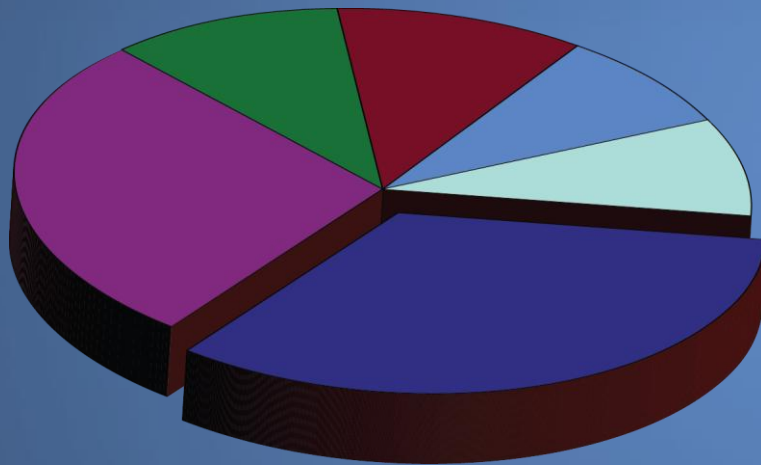
NTSB Recommendations

- MOST WANTED 1990 -2012
- ~200 fatigue recommendations



Complex Issue:

Requires Multiple Solutions



- Scheduling Policies and Practices
- Education/Awareness
- Organizational Strategies
- Healthy Sleep
- Vehicle and Environmental Strategies
- Research and Evaluation



NTSB Safety Recommendations: Fatigue

- 40 years ago: May 10, 1972
- “Revise FAR 135 to provide adequate flight and duty time limitations.” (A-72-55)
- Classified “Closed-Unacceptable”



NTSB Safety Recommendations: Fatigue Status (May, 2012)

- Total: 194
- Open: 48
- Closed: 146
- CUN*: 26

CUN = closed unacceptable



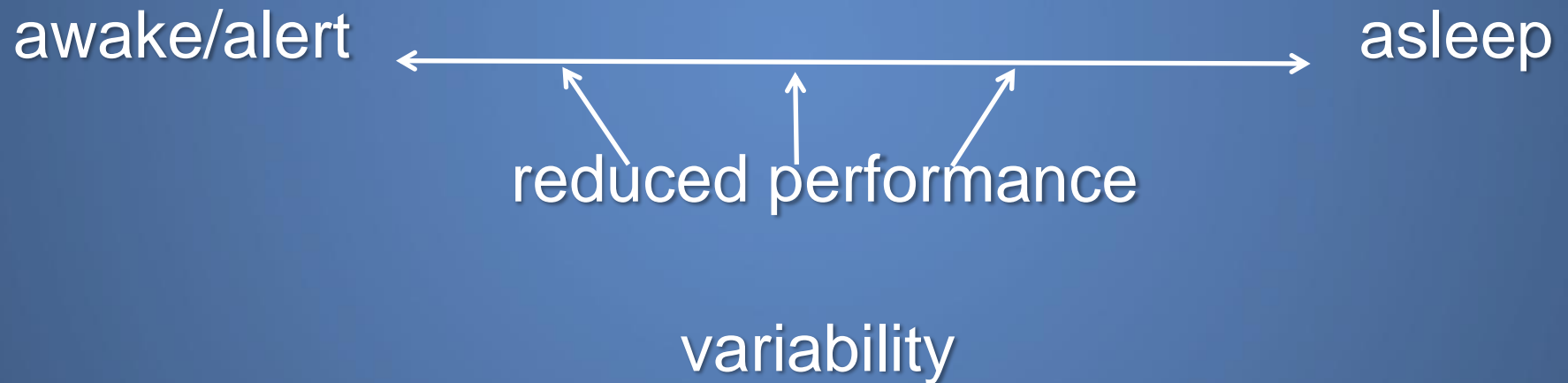
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Fatigue Risks

Fatigue can degrade
every aspect of
human capability.



Fatigue Risks

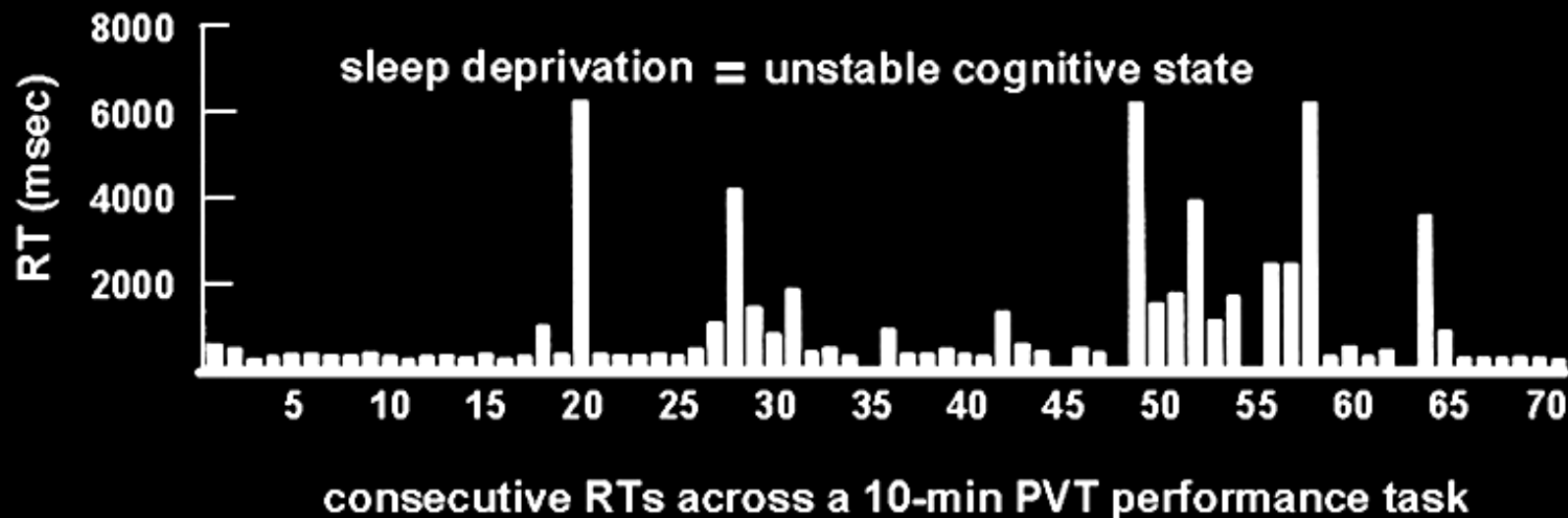
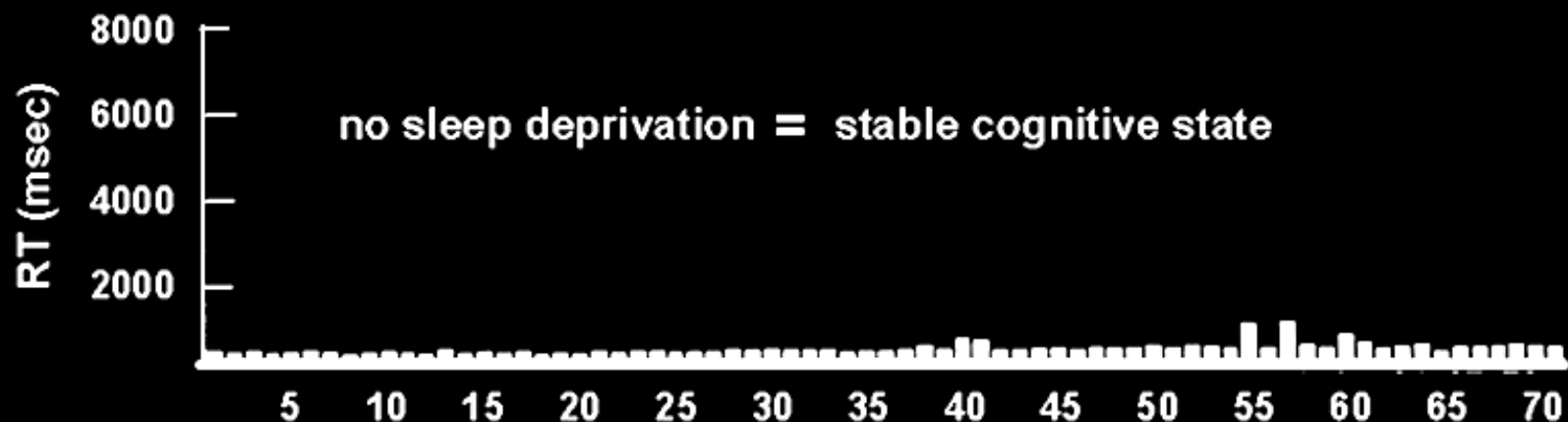


Fatigue Risks

- degraded 20 – 50%+:
 - reaction time
 - memory
 - communication
 - situational awareness
 - judgment
 - attention
 - mood
- increased:
 - irritability
 - apathy
 - attentional lapses
 - microsleeps



Fatigue and Reaction Times

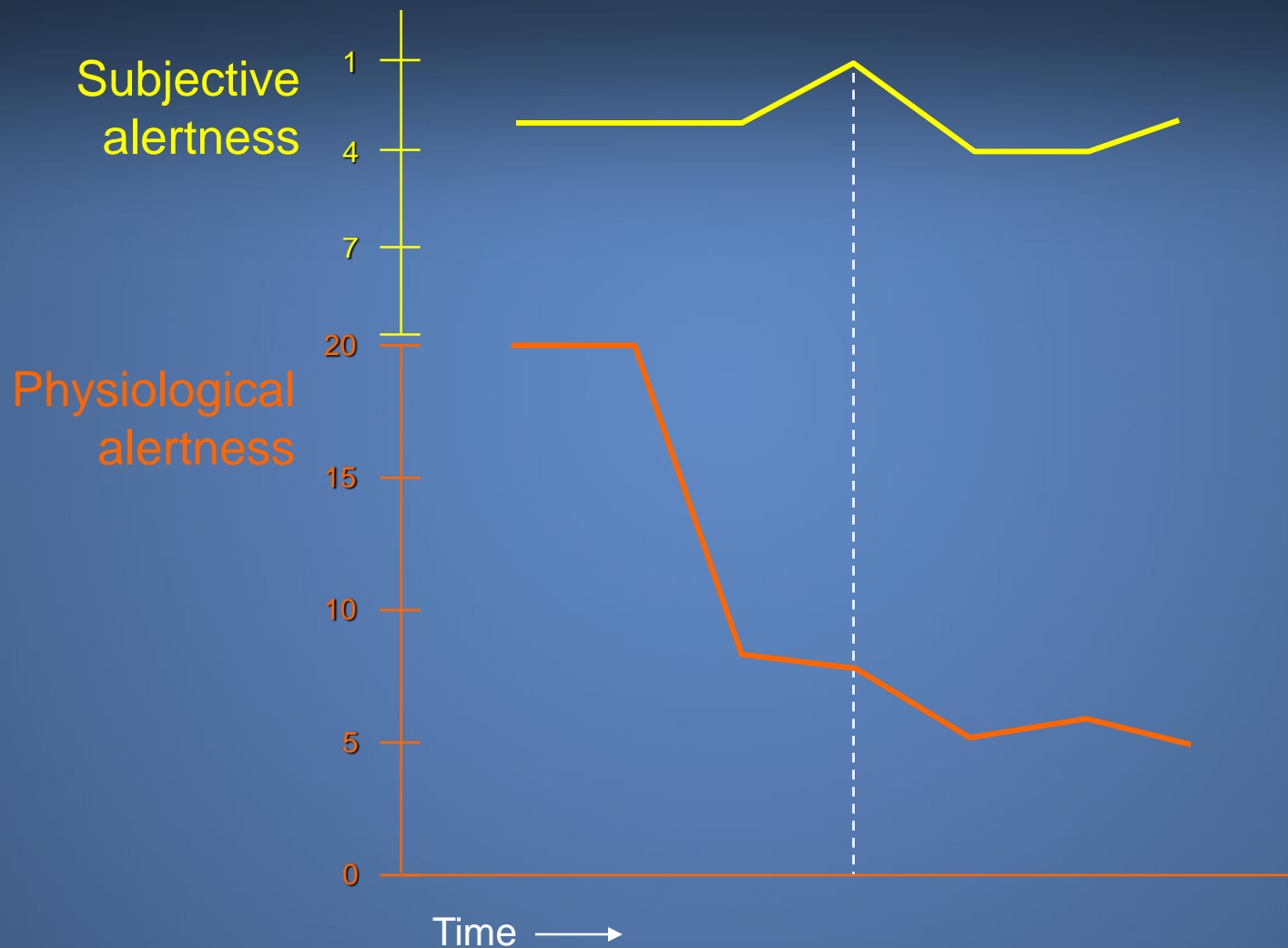


Doran SM, Van Dongen HP, Dinges DF. Sustained attention performance during sleep deprivation: evidence of state instability. *Archives of Italian Biology: Neuroscience* 2001;139:253-267.



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Alertness Reports Often Inaccurate



Adapted from Sasaki et al., 1986



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Animation of Accident Reconstruction

Motorcoach Run Off Road-Collision with Bridge Signpost

Interstate Highway 95 Southbound

New York, New York

March 12, 2011

HWY11MH005

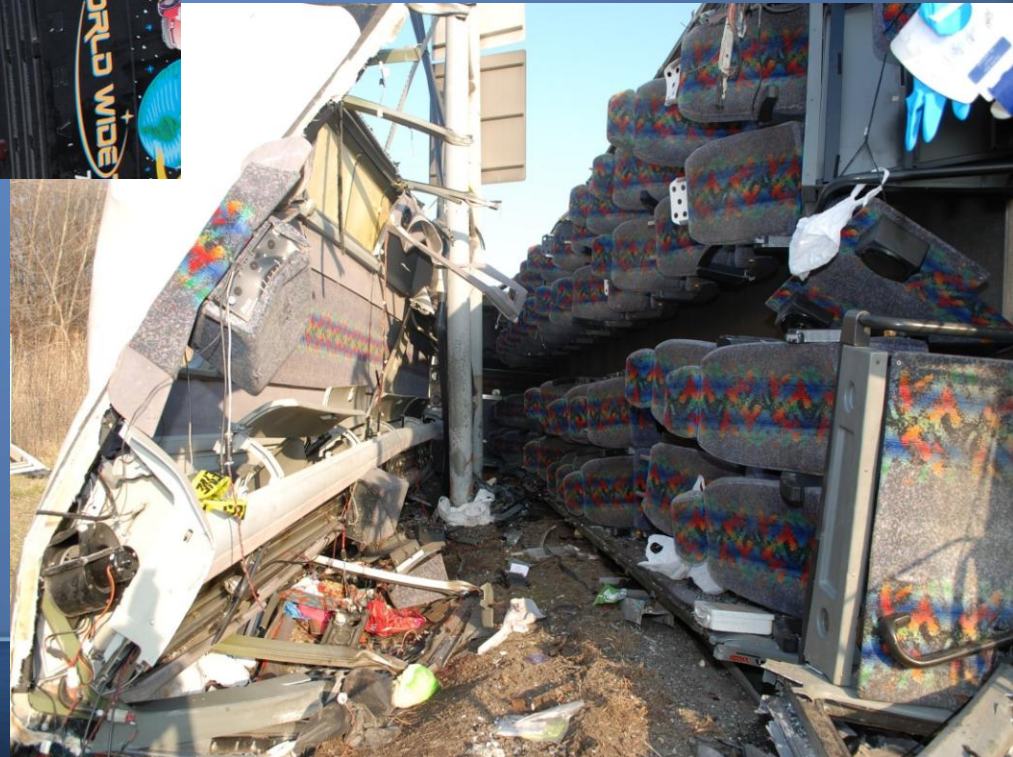


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'Bronx Bus', New York, NY (March 12, 2011)



15 fatalities
17 injuries



Probable Cause

“The National Transportation Safety Board determines that the probable cause of the accident was the motorcoach driver's failure to control the motorcoach due to fatigue resulting from failure to obtain adequate sleep, poor sleep quality, and the time of day at which the accident occurred.”



Success requires . . .

A culture change that supports
different attitudes and behaviors



#40 Ceremonial Swearing In



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Manage Fatigue = Enhance Safety

- Culture change
- Get educated
- Acknowledge risk
- Take action!



Good sleep, safe travels.



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